more clearly seen. A woodcut of the pelvis of the same species is especially valuable, and shows (as, indeed, had been previously well displayed in Prof. Cope's figure of the pelvis of *Eryops*) that the ossified pubis is very small, and takes no part in the formation of the acetabular cavity for the head of the femur. Another species of this genus from the Muschelkalk and Lettenkohle is described as *M. granulosus*, a second from the Lettenkohle as *M. acuminatus*, and a third from the true Keuper as *M. keuperinus*.

The genus *Capitosaurus* was originally described upon the evidence of a specimen of the skull from the Keuper of Franconia, a second species being subsequently described from the equivalent beds of Würtemberg as *C. robustus*; while *C. nasutus* and *C. fronto* are smaller forms from the Bunter of Bamburg. (It may be observed, in passing, that, in the Report of the British Association Committee, all mention of these two species from the Bunter is omitted, and it is thus only suggested that the genus might possibly be represented in these beds.) Dr. Fraas describes and figures a beautifully preserved skull of *C. robustus* from Stuttgart, which exhibits the very remarkable specific peculiarity that the epiotic gives off a process to join the supra-temporal, and thus converts the auditory slit into a foramen. The author would regard this feature as of sufficient importance to form a generic character, and he accordingly proposes to separate this species from *Capitosaurus*, with the appropriate designation of *Cyclotosaurus*. We are, however, rather inclined to agree with Prof. von Zittel, who regards the feature in question merely as a well-marked specific one.

Of still more importance are the skull and skeleton of *Metopias*. Hitherto, the occipital region of the skull of this genus has been undescribed; and the magnificent skull to which allusion has already been made shows that the restoration of this part by the British Association Committee was not altogether correct. The type species of *Metopias* must have been a huge creature, only second in point of size to *Mastodonsaurus*, its skull being some 2 feet in length. In addition to the skull, the affinities of this genus are illustrated by a slab showing both surfaces of the anterior half of the skeleton. In this beautiful specimen the three plates of the thoracic buckler are preserved in their natural position, and show well-marked differences from the corresponding bones of *Mastodonsaurus*. Thus, the median plate (interclavicle), instead of ending in a sharp posterior process like the corresponding bone (entoplastral) of a turtle, is rounded; while the lateral plates (interclavicles) meet in a long suture in advance of the median plate.

In thus making accessible to the scientific world the wonderful specimens of Triassic Labyrinthodonts preserved in the Museums of Germany, Dr. Fraas has laid all students of this branch of zoology under a deep obligation to him; and his work forms a fitting companion to the volumes containing Dr. Fritsch's description and illustrations of the smaller Labyrinthodonts of the older Permian beds of Bohemia. R. L.

NOTES.

THE proceedings of the Iron and Steel Congress seem to have excited much interest in America. About four hundred members of the Iron and Steel Institute and of the German Metallurgical Association are in New York, taking part in the meetings. The sittings of the American Institute of Mining Engineers began on Monday, those of the Iron and Steel Institute on Wednesday. According to the New York correspondent of the *Times*, the foreign delegates are much pleased with the arrangements made by the Americans for their reception.

THE Harveian Oration will be delivered by Dr. Andrew, at the Royal College of Physicians, on Saturday afternoon, October 18, at four o'clock.

THE eleventh annual "fungus foray" of the Essex Field Club will be held on Friday and Saturday, October 10 and 11, in Hatfield Forest, near Great Hallingbury, a remnant of about 1000 acres of the great forest of Essex. The head-quarters for the meeting will be at Bishop's Stortford. Papers will be read, and an exhibition of fungi and other botanical specimens held, under the direction of Dr. M. C. Cooke and Mr. George Massee. Any of our readers wishing to attend, should communicate with Mr. W. Cole, Hon. Sec., Essex Field Club, Buckhurst Hill, Essex.

THE Fruiterers' Company will hold an exhibition of fruit, at the Guildhall, London, on October 6, 7, and 8. Their objects are (1) to show what excellent fruit can be grown in this country; and (2) to afford information respecting the best sorts to plant, and how to cultivate them advantageously.

AT the annual meeting of the friends of the Manchester Technical School, held on Monday, it was resolved that the property and effects of the school should be transferred to the Whitworth Institute. A letter from Mr. Chancellor Christie, one of the trustees of the late Sir Joseph Whitworth, was read. In this letter he referred to the property of the Institute, and said the trustees were prepared absolutely to give and convey their property in Peter Street, of which at present the Technical School has the use. Upon the representations made to them that it was impossible for the Technical School to be carried on for the present unless it obtained from some source a subvention of £1000 a year, or thereabouts, the legatees had undertaken to provide that sum, if necessary, for a few years, and they had already made some annual payments of this amount. As, however, the Corporation of Manchester, under the powers conferred by the recent Act, had arranged for the payment of £2000 a year to the Technical School, the amount conditionally promised by the legatees would not be required. They were willing, in lieu of this, to contribute the sum of £5000 towards the building fund. The writer added, that while he should like to see a building in every respect adequate and satisfactory, he thought it would be a mistake to contemplate the immediate erection of a building on the scale of that of which plans were prepared about a year since. "The design, indeed, should embrace everything that could be needed for many years to come, but it should be so planned that a portion only could, and should, be immediately erected, leaving the rest for the future. In fact, it would follow the lines upon which the Owens College has been partially built. An expenditure of less than £100,000 should, I think, be sufficient for all the immediate purposes of the Technical School."

WITHIN the last few days, telephonic communication has been established between London, Manchester, Liverpool, and Lancaster by the National Telephone Company, Limited. The line is not yet open for use by the public, but it was placed at the disposal of the Manchester Field Naturalists' Society on Monday evening, when a discussion on the effects of fog and town atmosphere on plant-life was held between members in Manchester and a number of corresponding members in London. Dr. Bailey, of Owens College, proposed a scheme for the chemical examination of fog, with reference to its injurious effects on animal and vegetable organisms. Colonel Mackenzie, Superintendent of Epping Forest, denied its evil effects as far as plants were concerned; Prof. R. Meldola thought that the atmosphere of London was becoming more and more harmful to plants, and that this effect was probably due to the absence of light; Mr. Philip Hartog suggested that an attempt should be made to photograph the absorption spectrum of fog, and that a *daily* analysis of the air in large towns should be made in laboratories devoted to that purpose. A sub-committee was appointed to consider the subject further.

ANOTHER determination of the atomic weight of the element beryllium has been made by Drs. Krüss and Moraht, with the purest oxide that has probably ever been prepared (*Berichte*, No. 13, 2552). The result is eminently satisfactory to those who entertain a certain amount of belief in a modified "Prout's law," for the value obtained, 9·05 when oxygen is considered 16, is almost exactly a whole number, much nearer the round number 9 than the value obtained by Nilson and Petterson, 9·11, and the still earlier one of Awdejew, 9·22. The method employed consisted in igniting under special conditions the sulphate $BeSO_4 + 4H_2O$. The advantages attending the use of this salt are that it is capable of preparation by a method detailed in a former communication in an almost absolutely pure state, and it is not hygroscopic. The powdered crystals lose two molecules of their water of crystallization at 105° C., and the remaining two molecules at 250°–260°. When heated to redness the residual anhydrous sulphate is decomposed, beryllium oxide remaining. The last traces of sulphuric acid are completely removed by ignition to bright redness in a stream of air saturated with ammonia gas. The beryllia used for the preparation of the sulphate was obtained from three distinct minerals—leucophone, beryl, and gadolinite. Sixteen separate determinations were made, about 20 grams of the sulphate being ignited in each case. The excellent agreement between the results is seen from the fact that the maximum value obtained was 9·08, and the minimum 9·03, when oxygen = 16. It appears, therefore, that in the case of beryllium the value obtained for the atomic weight approximates the more closely to the whole number 9 the purer the materials and the more perfect the method employed in the work.

WRITING to us on the subject of sonorous sand, Mr. Henry C. Hyndman asks whether Prof. H. C. Bolton is aware of an inland locality in South Africa, where it is stated the sands are sonorous. In a recent letter to the *Scotsman*, Mr. Hyndman mentioned that he had come across a paragraph in a work entitled "Twenty-five Years in an African Waggon," by Andrew A. Anderton, published in 1887, in which the author said, "Before leaving this part of the Griqualand West I should like to describe that peculiar sand formation on the west side of the Langberg mountain, which is in fact part of it. I heard from many of the Griquas and Potgielet living near it, that the lofty hills are constantly changing; that is, the sand hills, 500 and 600 feet in height, in the course of a few years subside, and other sand hills are formed where before it was level ground." And then in a footnote it is added, "I regret very much the description of this sand formation has been left out, it being the only extraordinary geological formation known in Africa, and fully describes the musical sand."

THERE is an interesting article in *Education* on the University Correspondence College (London and Cambridge) and its founder. Mr. William Briggs is the principal and founder, and the idea of teaching by correspondence first suggested itself to him while holding the appointment to a Marquis of Bute Professorship in a Scotch College. The idea soon took root, and the general method of work now adopted is as follows:—Students every week receive a scheme of work, consisting of selections from text-books, indications of important points, hints, notes on difficult portions of each subject that is under consideration. At the end of the first week, in addition to the above, a test paper is sent on the work of the preceding week, the answers to which are sent to the tutor on an arranged day. These are then examined and returned with corrections, hints, and model answers in each subject and solutions of all the difficulties. The advantage this method has over oral teaching is that all difficulties, &c., are committed to writing, and can be looked at over and over again and kept for future reference. The staff employed consists of forty tutors, whose academical careers were exceptionally brilliant, twenty-six of them having taken first places at London University examinations. The best judgment as to the work of the students may be formed from the following information:—In the Intermediate and B.A. examinations, 79 and 70 passes were obtained in one year. In the Honour and M.A. examination, 105 at the recent June examination passed, including the tenth, thirteenth, and seventeenth places in the Honour list; at Intermediate Arts, twenty took honours, one with a first and two with second places; at B.A., sixteen took honours, one being University Prizeman.

THE Durham College of Science, Newcastle-upon-Tyne, has issued its Calendar for the session 1890–91. The schedules for the A.Sc. and B.Sc. degrees have been re-modelled, and are now on the same lines as the corresponding examinations in the London and Victoria Universities. Attention may also be drawn to the fact that the list of subjects on which courses of lectures are delivered includes agricultural botany.

THE Calendar of the University College of North Wales for the year 1890–91 has been published.

WE have received the calendar of the Imperial University of Japan (Teikoku Dargaku) for the year 1889–90 (22nd–23rd year of Meiji), published by the University at Tokyo. This University is under the control of the Minister of State for Education, and depends for its revenue upon annual allowances from the Treasury of the Imperial Government. An accumulation fund, made up of tuition fees and other sources, helps to pay the current expenditure of the University when the cases are of such a nature as to demand the outlay. The whole University, consisting of offices of the University, library, colleges of law, medicine, engineering, literature, and science, the first hospital of the College of Medicine, &c., are situated in the grounds at Molofujicho, Hongo, Tokyo, known as Kaga-yashiki. The Botanical Garden Observatory and the second hospital of the Medical College are all situated within the city bounds, and the Marine Biological Station is situated at Misaki. The Calendar contains information on everything concerning the University, viz. University offices, regulations for colleges, courses of instruction, examinations, scholarships, fees, &c. The appendix gives the address delivered by President Watanabe on the occasion of the annual graduation ceremony, July 10, 1889.

M. E. DRAKE DEL CASTILLO has recently published a memoir, rewarded by the French Academy of Sciences, on the Flora of Polynesia.

A CATALOGUE of numerous works in every branch of astronomy has been issued by Felix L. Dames, Berlin, W., Taubenstrasse 47. To those who may wish to have copies of rare and standard astronomical publications at a reasonable price it will be found extremely useful.

MESSRS. G. PHILIP AND SONS, Fleet Street, have published a portable sun-dial adjustable for all latitudes and fitted with a compass. The model has been designed to illustrate simply and accurately the principle of the sun-dial. The equation of time on the 1st, 11th, and 21st of each month is given, so that civil time may be found. No table is given of magnetic variation, hence the fixing of the instrument in the magnetic instead of the geographical meridian involves a certain amount of error. The box into which the model fits is made exactly one cubic decimetre in capacity, and is intended to illustrate the decimal system of weights and measures.

THE *Engineer* of the 19th inst. contains an important article on "Railway Axles in India," due to a remarkable statement in the Indian technical press, to the effect that steel railway axles had not given satisfaction, and that at considerable expense iron axles were to be substituted for them. Our contemporary observes that questions have, naturally enough, been asked, and publishes Sir A. M. Rendel's reply :—" I originally," he says, "recommended the use of steel for axles on the Bombay, Baroda, and Central India metre gauge, because I thought that steel was not only better than iron, but because its price was not more than half that of the class of iron suited for axles. I was further moved to do so by an opinion that, whilst steel was improving in quality, and daily taking the place of the best classes of iron, the quality of those classes of iron must deteriorate, because the price obtainable for them must diminish. In respect to the relative price of steel and iron, I was quite right; in respect to their relative suitability for axles, I have been wrong, or, at any rate, premature. *Commercial steel, when used in axles, seems subject to deterioration, which makes it very brittle after a few years' wear.* The consequence is that we must do now what we should certainly have done at first, had all the facts been then before us—I mean, we must substitute iron for steel. It being also desired that our waggon loads should be increased, it has been found necessary to increase the size of our axles, and their weight in iron is now 231 lbs., instead of 198 lbs. in steel; and their present cost is £2 6*s.*, instead of about £1 2*s.* 6*d.* Had we originally supplied the large iron axles, capital would have been charged, for every such axle supplied, the sum of £2 6*s.* or thereabouts, instead of £1 2*s.* 6*d.*, and I can see no reason why, because we attempted an economy in the first instance, which experience has proved to be impracticable, capital should escape the larger charge now. It appears to me indisputable that the difference between the cost of the axles originally supplied and those now sent out should be charged to capital and not to revenue." The italics in this quotation are those of the *Engineer*, and the statement is a grave charge against steel, and one that the steel manufacturers will no doubt combat strongly. The *Engineer* does not tell us where these metre gauge axles have usually failed, and it is therefore difficult to find a reason for the wholesale rejection of steel as a suitable material for axles, always bearing in mind the general use of this material in this country for that purpose, with the greater mileage run with steel axles, be they crank or straight axles, over that obtainable from iron axles. It is to be hoped that the matter will be thoroughly thrashed out. The question of manufacture must not be overlooked. Steel rails occasionally fail at the ends owing to insufficient "crop" being cut off the rolled rail, *i.e.* the steel is not considered sound for about 3 feet from each end of the rail as it leaves the rolls, and is therefore usually rejected as "crop ends." If these axles are rolled ones, probably this might explain the failures, if they usually took place at the ends and not in the middles.

THE autumn series of science lectures at the Royal Victoria Hall began on Tuesday with a lecture on "Nebulæ," by Mr. J. D. McClure. The arrangements for lectures during the month of October are as follows :—October 7, "The Sun," by J. D. McClure; October 14, "Bees as Florists and Fruit Producers," by Rev. Prof. Cheshire; October 21, "The Colours of Animals and their Uses," by Dr. W. D. Halliburton; October 28, "Mountaineering," by H. G. Willink.

THE additions to the Zoological Society's Gardens during the past week include a Brown Bear (*Ursus arctos* ♂) from Russia, presented by Mr. G. W. Robinson; a Golden Eagle (*Aquila chrysaëtus* ♀) from the Rocky Mountains, Wyoming, U.S.A., presented by Mr. Percy Cooper; two Common Squirrels (*Sciurus vulgaris*), British, a Reticulated Python (*Python reticulata*) from Siam, purchased; five Viperine Snakes (*Tropidonotus viperinus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on October 2 = 22h. 46m. 16s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 4827	—	—	22 36 13	+60 42
(2) G.C. 4883	—	—	22 55 43	+29 33
(3) β Pegasi	2	Yellowish-red.	22 58 12	+27 29
(4) π Aquarii	5	Yellowish-white.	22 19 42	+ 0 49
(5) η Aquarii	4	White.	22 29 42	− 0 41
(6) α Pegasi	2	White.	22 59 18	+14 37
(7) 257 Schj.	9	Reddish-yellow.	21 51 9	+49 59

Remarks.

(1) In the spectrum of this nebula Dr. Huggins has recorded only the chief nebula line near λ 500. It is remarkable that Herschel describes it as easily resolvable, and if this be correct the nebula must be regarded as a cluster of nebulous stars. This important result is well worth checking, both by telescopic and spectroscopic observations.

(2) This nebula is described as "considerably bright; considerably large; little elongated; gradually much brighter in the middle; mottled as if with stars." The spectrum of the nebula is rather vaguely described by Dr. Huggins as follows: "The spectrum does not consist of one or two lines only; I believe it is continuous." The doubt should be removed by a more definite observation.

(3) The spectrum of this star is a very fine one of Group II. The dark bands, however, are by no means so strongly developed as they are in α Herculis or Mira, but still they are well marked, and, in addition, the spectrum abounds with lines. The relative feebleness of the bands, and the presence of so many lines, indicates that the star is well advanced in condensation, and this is further confirmed by my own observation of the comparatively feeble bright flutings of carbon. Most of the lines are identical with those seen in Aldebaran. D is partly hidden by a dark fluting, but lines in other places stand out prominently. They are not quite like those seen in the solar spectrum, and hence the spectrum of the star is one from which useful information relative to the criteria between Groups III. and V. may be derived.

(4) Prof. Pickering has found by photography that the spectrum of this star contains bright lines. Vogel, however, describes the spectrum as a well-marked one of the solar type, and makes no mention of bright lines. In my own observations of the star I found the dark lines characteristic of the spectrum of a star like the sun, but detected no bright ones. It is quite possible, therefore, that the bright lines are not always visible, and the spectrum should be examined with reference to a possible periodicity.

(5) According to the observations of Konkoly, this star has a well-marked spectrum of the solar type, but Gothard and Vogel describe it as one of Group IV. My own observations confirm those of Vogel.

(6) A star of Group IV.

(7) This faint star has a spectrum of Group VI., and Dunér states that the dark carbon band which separates the green and yellow zones is wider than he has seen it in any other star. The blue zone is scarcely perceptible. It seems as if this is a star which has cooled down until it is almost non-luminous, and the observation is important as indicating to a certain extent what the spectrum will be at the last stage of visibility. It appears that the carbon absorption intensifies until finally all the remaining light is absorbed. A. FOWLER.

THE TELLURIC SPECTRUM.—The current number of *Comptes rendus* (September 22) contains an account of the expedition lately made to the summit of Mont Blanc by M. Janssen, for the purpose of observing the spectrum of the sun from an elevated station. Two years ago M. Janssen ascended Mont Blanc as far as the Grands-Mulets, a station having an altitude of 3050 metres. The spectroscopic observations then made showed that a diminution took place in the intensity of the groups of lines A, B, and a, due to the action of the oxygen in the atmosphere, and indicated very definitely that at the limits of our atmosphere these groups would disappear. To confirm these results it was resolved this year to repeat the observations at a greater elevation,